



(12) **EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:
11.06.2014 Bulletin 2014/24

(51) Int Cl.:
G01D 5/347 (2006.01)

(43) Date of publication A2:
13.09.2006 Bulletin 2006/37

(21) Application number: **06004767.7**

(22) Date of filing: **08.03.2006**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

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(30) Priority: **11.03.2005 JP 2005069579**

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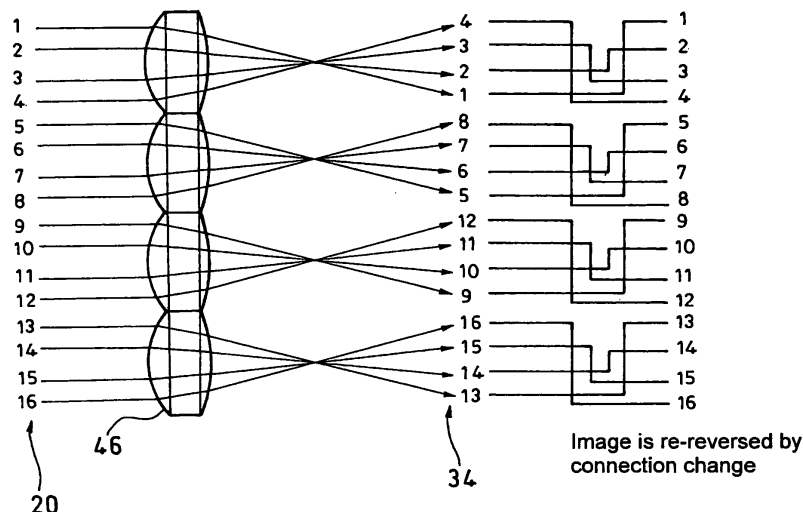
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(54) **Photoelectric encoder**

(57) A photoelectric encoder is provided which has an optical system including a first lens array inserted between a main scale and a light receiving element. An image divided or reversed by the first lens array can be

electrically or optically re-reversed. This can achieve the reduction of the entire size as well as increase in the scale field of view, while maintaining the image shape and/or pattern.

Fig. 13





EUROPEAN SEARCH REPORT

Application Number
EP 06 00 4767

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 03/087706 A2 (HEIDENHAIN GMBH DR JOHANNES [DE]; BENNER ULRICH [DE]; MAYER ELMAR [DE]) 23 October 2003 (2003-10-23)	1	INV. G01D5/347
Y	* page 10, line 31 - page 12, line 24 * * figures 1,2 * * claim 1 *	6	
X	EP 1 099 936 A1 (RENISHAW PLC [GB]) 16 May 2001 (2001-05-16) * paragraph [0011] - paragraph [0018] * * paragraph [0024] - paragraph [0025] * * figure 2 *	1	
Y	EP 1 487 199 A1 (FUJI PHOTO OPTICAL CO LTD [JP]; TAKAMI HASEGAWA [JP] FUJIFILM CORP [JP]) 15 December 2004 (2004-12-15) * paragraph [0022] - paragraph [0023] * * paragraph [0056] - paragraph [0058] * * figures 1,5,6 *	6	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			G01D
3	Place of search Munich	Date of completion of the search 30 April 2014	Examiner Paraf, Edouard
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

EPO FORM 1503 03.82 (P04C01)



Application Number

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☒ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

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- ☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:
- ☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



**LACK OF UNITY OF INVENTION
SHEET B**

Application Number

EP 06 00 4767

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claim: 1

Incremental type photoelectric encoder having an optical system including a first lens array inserted between a main scale and a light receiving element, wherein pitches of the respective lenses are brought into agreement with a period of the main scale or natural number multiple thereof.

2. claims: 2-5

A photoelectric encoder having an optical system including a first lens array inserted between a main scale and a light receiving element, and wherein a second lens array with a set pitch of lenses identical to the first lens array and a third lens array that optically re-reverses the light emitted from the second lens array are provided.

3. claim: 6

A photoelectric encoder having an optical system including a first lens array inserted between a main scale and a light receiving element, and wherein connection of outputs of a light receiving element array is changed to electrically re-reverse an image that has been divided and reversed by the first lens array.

4. claim: 7

A photoelectric encoder having an optical system including a first lens array inserted between a main scale and a light receiving element, and wherein a second lens array with a set pitch of lenses identical to the first lens array, and a plurality of small mirrors with a set pitch identical to that of respective lenses of the lens arrays are provided to optically re-reverse an image that has been divided and reversed by the first lens array, by the small mirrors.

5. claims: 8-10

A photoelectric encoder having an optical system including a first lens array inserted between a main scale and a light receiving element, and wherein a second lens array with a set pitch of lenses identical to the first lens array, a mirror for making light emitted from the second lens array again be incident on the second lens array, and a half mirror for extracting the light passing through the second lens array twice towards a direction of the light receiving



**LACK OF UNITY OF INVENTION
SHEET B**

Application Number

EP 06 00 4767

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

element are provided to optically re-reverse an image that has been divided and reversed by the first lens array, by the mirror.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 06 00 4767

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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30-04-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 03087706 A2	23-10-2003	AT 398760 T	15-07-2008
		CN 1646883 A	27-07-2005
		DE 10217726 A1	27-11-2003
		EP 1497609 A2	19-01-2005
		ES 2307959 T3	01-12-2008
		JP 4266834 B2	20-05-2009
		JP 2005522682 A	28-07-2005
		US 2005168757 A1	04-08-2005
		WO 03087706 A2	23-10-2003
EP 1099936 A1	16-05-2001	EP 1099936 A1	16-05-2001
		JP 4714333 B2	29-06-2011
		JP 2001194187 A	19-07-2001
		US 6603115 B1	05-08-2003
EP 1487199 A1	15-12-2004	CN 1573505 A	02-02-2005
		EP 1487199 A1	15-12-2004
		JP 2005004181 A	06-01-2005
		US 2005012843 A1	20-01-2005